Graphene nearfield effects for biosensing and quantum photonics applications

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Recently we showed that graphene can be used as a nanoscale ruler in biosensing assays [1]. More specifically we show that Graphene's nearfield effects can be applied to study the DNA hybridization process. We will present our recent advancements towards developing a Graphene based single molecule sensitive platform, that are able to assess the DNA unfolding kinetics using a widefield TIRF microscopy approach. We further extend the nearfield quenching from a distance technique [2] to a thickness measurement technology for 3D nano- and microtopology metrologies [3]. We apply this new method to study the dynamics of drying droplets. Lastly we will present our work towards using Graphene for quantum photonics applications. Here, we aim to explore the nearfield quenching effects of Graphene to produce single quantum emitters on demand, and study van de Waals heterostructures such as hexagonal Boron Nitride-Graphene based bilayers. One future aim is to explore their quantum sensing properties, similar to what can be done in quantum metrology based on point defects in diamond, most well known the photostable Nitrogen Vacancy center, for magnetic field sensing e.g. for the spatial characterization of magnetic fields surrounding relevant magnetic nanostructures [4].

References

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Figures

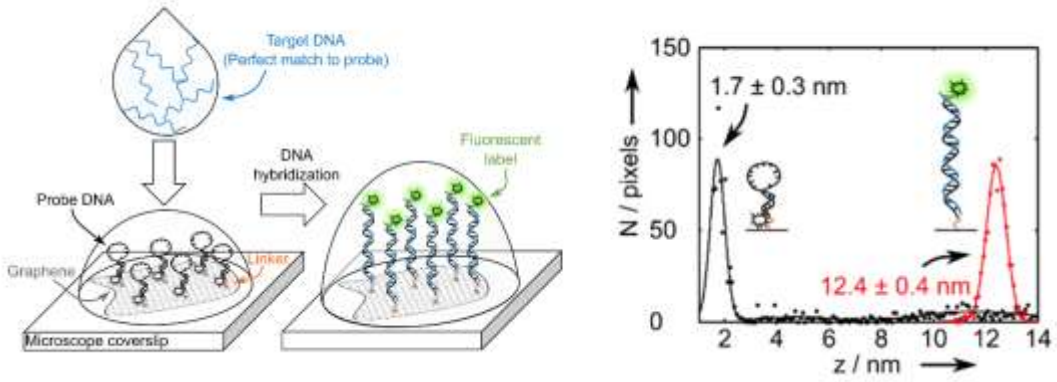

Figure 1: Visualization of the Graphene genosensor. The fluorescent label attached to the DNA hairpin will experience fluorescence lifetime changes being modulated in dependence of the dye from the Graphene (left). Fluorescence lifetime based information of fluorophore-graphene distance (z) in nanometers for various image pixels of a fully quenched (black) and a hybridized sensor chip (red), where the fluorophore attached to the double stranded DNA reaches distances to the Graphene of about 12 nm the full estimated extension of 29 base pair DNA strand used (taken with modifications from Ref.: [3]((right).